lighting basics

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THE FUNDAMENTALS OF LIGHTING

I'm sure you've heard this, "If you light it right..." or "With good lighting, the scene will..." What does that mean? What is "good" lighting?

Lighting has nearly infinite permutations and variations. There is certainly no one "right" way to light a scene. As a result, there is no chance that we can just make a simple list of "proper" lighting techniques. What we can do, however, is try to identify what it is we want lighting to do for us. What jobs does it perform for us? What do we expect of "good" lighting? Starting this way, we have a better chance of evaluating when lighting is working or us and when it is falling short. Naturally, these are generalizations. There are always exceptions, as there are in all aspects of filmmaking — staging, use of the lens, exposure, continuity, editorial, and so on.

What are the Goals of Good Lighting?

So what is it we want lighting to do for us? There are many jobs, and they include creating an image that has:

- A full range of tones and gradations of tone
- Color control and balance
- Shape and dimension in the individual subjects
- Separation: subjects stand out against the background
- Depth and dimension in the frame
- Texture
- Mood and tone: emotional content
- Exposure

Full Range of Tones

In most cases, we want an image to have a full range of tones from black to white (tonal range is always discussed in terms of grayscale, without regard to color). There are exceptions to this, of course, but in general, an image that has a broad range of tones, with subtle gradations all along the way, is going to be more pleasing to the eye, more realistic, and have more impact.

In video and High Def, a proper test chart is essential in preparing the camera to achieve this — to make sure that your camera setup will allow you to capture a full range of tones in your image. This means that your black will be truly black and your white truly white and also that there is a smooth transition throughout the grayscale range with every nuance of gray tone represented.

Naturally, this may not be the final image structure you are aiming for. It's not meant to be — it's a reference that you can reliably return to time after time and a standard from which to judge the contrast and range of your camera setup and thus your scene lighting. From there you have a known starting point for beginning to create the image structure that is right for the scene you are shooting.

Color Control and Color Balance

There are two sides of use of color in lighting and use of the camera. Color balance refers to adjusting the video camera to the lighting conditions (or in film selecting the right film stock or using the correct filter), while color control refers to altering the lighting through the use of different lighting units or putting gels on the lights. First, (unless you are going for a specific effect), the lighting itself must be color balanced. The two most common standards are daylight balance (5500K) and tungsten balance (3200K), but other balances are possible either using a gray card or a test chart or by white balancing

Figure 7.1. (previous page) Dramatic shafts of light through rain and smoke make this frame from *Nine and 1/2 Weeks* a powerful and striking visual.

to a neutral card. This would likely be the most desirable route with lighting you can't control, such as in an office with fluorescent lighting you can't change. Up until the eighties, it was conventional to precisely color balance all lighting sources in a scene. Now with constantly improving video cameras, better film stocks, and most of all, changing visual tastes, it is common to mix slightly, even radically, different color sources in a scene (see the chapter *Color* for examples). In making these decisions you will need to pay close attention to exposure, color balance, filtration, correct processing (for film), and proper camera setup (in the case of video cameras). Color control is also important in the mood and tone of a scene (Figure 7.3).

Shape

Flat front lighting (Figure 7.11) does not reveal the shape and form of the subject. It tends to flatten everything out, to make the subject almost a cartoon cutout: two-dimensional. Lighting from the side or back tends to reveal the shape of an object — its external structure and geometric form.

This is important not only for the overall depth of the shot, but it also can reveal character, emotional values, and other clues that may have story importance. Naturally, it also makes the image more real, more palpable, more recognizable; this is important not only for each subject in the frame, but to the overall picture as well.

Separation

By separation, we mean making the main subjects "stand out" from the background. A frequently used method for doing this is a backlight. Another way to do it is to make the area behind the main subjects significantly darker or brighter than the subject. In our quest to make an image as three-dimensional as possible, we usually try to create a foreground, midground, and background in a shot; separation is an important part of this.

Figure 7.2. (top) Color plays a major role in imagemaking: issues of color balance in relation to camera white balance are crucial to achieving the image you want. If the camera and monitor are not properly calibrated, your task is going to be much more difficult.

Figure 7.3. (above) Out of the ordinary color is frequently appropriate for sci-fi, horror, or fantasy sequences.

Figure 7.4. Two devices are used to add visual texture to this light: a 4x4 *cuculoris* (also called a *cookie*) and a heavy smoke effect.

Depth

As images, what are film and HD? They are flat rectangles — it is a two-dimensional medium (3D is another matter). As lighting people, cinematographers, and directors, a big part of our job is trying to make this flat art appear as three-dimensional as possible — to give it depth and shape and perspective, to bring it alive as a real world as much as possible. Lighting plays a huge roll in this. Use of the lens, blocking, camera movement, set design, color, and other techniques play a role as well, but lighting is our key player in this endeavor.

This is a big part of why "flat" lighting is so frequently the enemy. Flat lighting is light that comes from very near the camera, like the flash mounted on a consumer still camera: it is on axis with the lens. As a result it just flatly illuminates the entire subject evenly. It erases the natural three-dimensional quality of the subject.

Texture

As with shape, light from the axis of the lens (flat lighting) tends to obscure surface texture of materials. The reason is simple: we know texture of the subject from the shadows. Light that comes from near the camera creates no shadows. The more that light comes from the side, the more it creates shadows, which is what reveals texture. Texture can also be present in the lighting itself (Figure 7.4).

Mood and Tone

Let's recall our discussion of the word "cinematic." Used in conversation, it is often used to describe something that is "movie-like." For example, someone might say a particular novel is cinematic if it has fast-moving action, lots of description, and very little exposition. That is not how we will use the term here. In this context, we will use the term cinematic to describe all the tools, techniques, and methods we use to add layers of meaning, emotion, tone, and mood to the content.

As every good camera and lighting person knows, we can take any particular scene and make it look scary or beautiful or ominous or whatever the story calls for, in conjunction with use of lens and camera, of course. Many tools affect the mood and tone of a scene: color, framing, use of lens, frame rate, handheld or mounted camera — indeed everything we can do with camera and lighting can be used to affect the audience's perception of the scene.

Figure 7.5. (top) Lighting can create depth and three-dimensionality in a scene. Here, the actress is lit only with a soft key; the scene is flat, two-dimensional and doesn't seem real. In **Figure 7.6** (bottom) the addition of a backlight, a practical lamp, and lighting through the window and in the hallway makes the scene more three-dimensional and realistic.

Exposure and Lighting

Lighting does many jobs for us, but none of them matter if you don't get the exposure right: incorrect exposure can ruin whatever else you have done.

In terms of lighting, just getting enough light into a scene to get an exposure is usually not difficult. What is critical is correct exposure. Certainly, it is a job for lighting, (in addition to the iris, frame rate, gain, and shutter angle) but don't forget to think of it as an important image making and storytelling tool. Most of the time we want nominally "correct" exposure (see the chapter *Exposure*).

It is important to remember in this context that exposure is about more than just "it's too light" or "it's too dark." Exposure for mood and tone is obvious, but there are other considerations as well. For example, proper exposure and camera settings are critical to color saturation and achieving a full range of grayscale tones.

There are really two ways in which you have to think about exposure. One is the overall exposure of the scene; this is controlled by the iris, the shutter speed, gain and neutral density filters. All of this controls exposure for the entire frame. Except for some types of neutral density filters (called *grads*), there is no chance to be selective about a certain part of the frame.

Another aspect of exposure is balance within the frame. As is discussed in the chapter on exposure, film and video can only accommodate a certain brightness range. Keeping the brightness range within the limits of your particular film or video camera is mostly the job of lighting. Again, it's not merely a technical job of conforming your lighting to the available latitude: the lighting balance can also affect the mood, tone, style, and overall look of the scene.

Figure 7.7. Strong, simple primary colors can be a powerful element in any image.

SOME LIGHTING TERMINOLOGY

Key light: The dominant light on people or objects. The "main" light on a scene.

Fill light: Light that fills in the shadows not lit by the key light. Lighting is sometimes described in terms of the *key/fill ratio*.

Backlight: Light that hits a person or objects from behind and above. A rim/edge light might be added to separate a dark side of a face or object from the background or make up for a lack of fill on that side. Frequently, back light can be overexposed and still record well on tape or film. Also sometimes called a *hair light* or *shoulder light*.

Kicker: A kicker is a light from behind that grazes along an actor's cheek on the fill side (the side opposite the key light). Often a kicker defines the face well enough that a fill is not even necessary. It should not be confused with a backlight, which generally covers both sides equally.

Sidelight: A light comes from the side, relative to the actor. Usually dramatic and creates great chiaroscuro (if there is little or no fill light), but may be a bit too harsh for close-ups, where some adjustment or slight fill might be needed.

Topper: Light directly from above. The word can also refer to a flag that cuts off the upper part of a light (see chapter *Tools of Lighting*).

Hard light: Light from the sun or small lighting source such as a Fresnel that creates sharp, well-defined shadows. Even a large 10K is still only a small source in relation to the subject being lit.

Figure 7.8. Lighting is your primary tool in establishing mood and tone, which add layers of meaning to the content. This shot is lit with a *Mighty Mole* bouncing off the concrete floor.

Soft light: Light from a large source that creates soft, ill-defined shadows or (if soft enough), no shadows at all. Skylight on an overcast day is from many directions and is very soft.

Ambient light: There are two uses of this term. One means the light that just happens to be in a location. The second use of the term is soft, overhead light that is just sort of "there."

Practicals: Actual working prop lights — table lamps, floor lamps, sconces, and so on. It is essential that all practical lamps have a dimmer on them for fine-tuning control; small dimmers for this purpose are called *hand squeezers*.

Upstage: Part of the scene on the other side of the actors, opposite the side the camera is on. **Downstage** is the side the camera is on. Comes from theater when stages were raked (tilted) and upstage was the part farthest away from the audience.

High key: Lighting that is bright and fairly shadowless with lots of fill light; often used for fashion and beauty commercials.

Low key: Lighting that is dark and shadowy with little or no fill light. Can also be described as having a high key/fill ratio.

Bounce light: Light that is reflected off something — a wall, the ceiling, a white or neutral surface, a silk, or just about anything else.

Available light: Whatever light already exists at the location. May be natural light (sun, sky, overcast day) or artificial (streetlights, overhead fluorescents, etc).

Motivated lighting: Where light in the scene appears to have a source such as a window, a lamp, a fireplace, and so on. In some cases the light will come from a source visible in the scene; in some cases, it will only *appear* to come from a source that is visible in the scene.

Figure 7.9. (top) Hard light creates sharp, well-defined shadows.

Figure 7.10. (bottom) Soft light creates soft shadows that fall off gradually.

ASPECTS OF LIGHT

What are the variables when we work with light? Given its nearly infinite possibilities, the number of factors are surprisingly few:

- Quality (hard vs soft)
- Direction
- Altitude
- Color
- Intensity
- Texture

Although understanding light is a study that lasts a lifetime and there are nearly infinite ways to light a scene, when we boil it down to the basics, there are really only a few variables that we deal with in lighting. These are the aspects of light that we work with as we work on a scene.

Hard Light and Soft Light

What makes hard light hard? What makes soft light soft? How do we distinguish between them? There are many ways to light any scene; the variations are endless. The styles and techniques of lighting are nearly infinite. Oddly, there are really only two types of light (in terms of what we are calling *quality of light*) when you really boil it down to the basics: *hard light* and *soft light*. There are all sorts of subtle gradations, and variations between completely hard and fully soft, but in the end there are just these two types that exist at opposite ends of a continuum.

Figure 7.11. (top) Flat front lighting creates no depth, no sense of three-dimensionality. It looks fake and "lit" — something we try to avoid.

Figure 7.12. (bottom) Light from the sides or back (anything other than flat front lighting) creates depth, dimension, a more realistic feel.

Hard Light

Hard light is also called *specular* light. It is light that casts a clear, sharp shadow. It does this because the light rays are traveling parallel, like a laser. What creates a beam of light with the rays pretty much parallel? A very small light source. The smaller the source, the harder the light will be. This is an absolutely crucial point: how hard or soft a light appears is a function of the size of the source.

Outside on a clear, sunny day, take a look at your shadow: it will be sharp and clean. Even though the sun is a large star, it is so far away that it appears as a small object in the sky — which makes it a fairly hard light.

Soft Light

Soft light is the opposite; it is light that casts only a fuzzy, indistinct shadow; sometimes no shadow at all. What makes light soft? A very large source. Go outside on a cloudy day and you will have little or no shadow at all. This is because instead of a small, hard source (just the sun), the entire sky is now the light source — it's enormous. See Figures 7.9 and 7.10 for examples of hard and soft light.

How do we make soft light on the set? There are two ways. One is we *bounce* a light off a large white object. Typically we use things like *foamcore* (a lightweight artist board often used for temporary signs or mounting photographs). The bigger the *bounce* is, the softer the light will be. You can use almost anything light-colored as a bounce: a white wall, an umbrella, a piece of white styrofoam building insulation (also called *bead board*). For larger applications, there are several materials that come in sizes from 4'x4' up to as large as 20'x40' and

Figure 7.13. (top) *Upstage* is on the other side of the actors, away from the camera. Light from the upstage side (the side away from camera) gives pleasant shadows and is flattering to the face.

Figure 7.14. (bottom) *Downstage* is on the same side of the actors as the camera. Lighting from the *downstage* side is unpleasant for the face, puts the shadows in the wrong place, and more flat front lighting.

sometimes even larger. On the film *Memoirs of a Geisha*, for example, very large *silks* were used to cover virtually the entire set, which was several acres in size.

Another way is to direct the light through *diffusion*. In the past, photographers used things like thick white tracing paper or white shower curtains as diffusion. Nowadays, there are many types of diffusion available in wide rolls and sheets. It is amazing for its ability to withstand the intense heat of being put right in front of a powerful light. Diffusion may be attached directly to the *barn doors* of a light or held in a frame in front of the light, or attached to a window, etc.

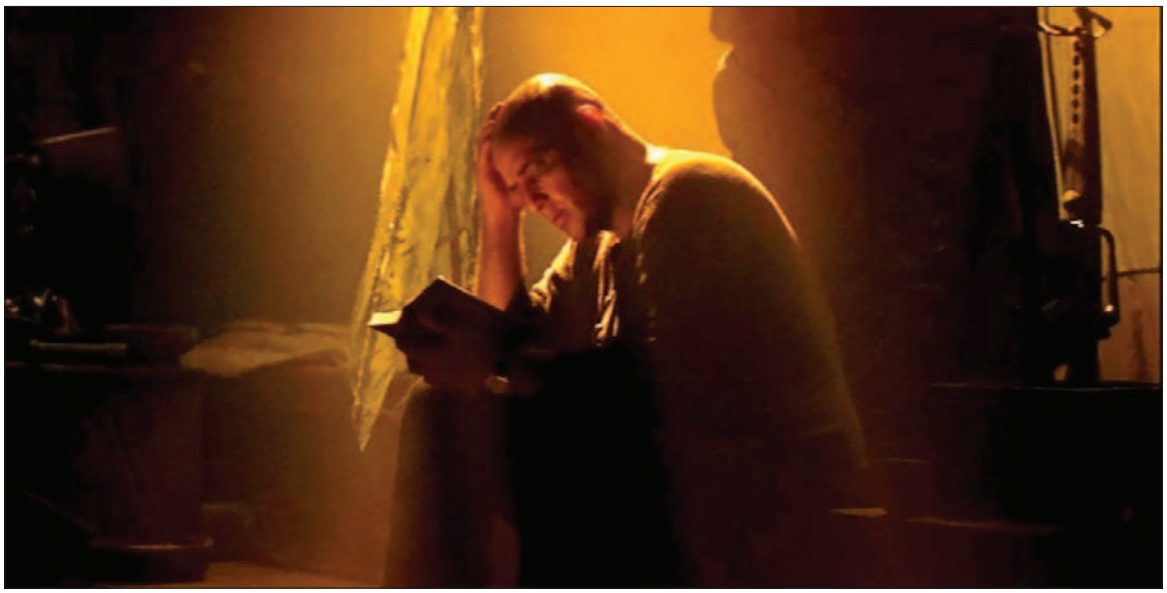

Figure 7.15. A powerful *backlight* and a *bounce* off the book create a look that perfectly reinforces the character of Col. Kurtz and his mental state of isolation and insanity in this scene from *Apocalypse Now*.

Many types of diffusion material are available in varying grades — from very *light,* almost translucent up to very *heavy* diffusion. A popular light diffusion is *opal*; it is so thin you can almost see through it. This doesn't make the light very soft, but sometimes we want a very subtle effect. Heavier diffusion is much thicker, and it makes the light much softer. About the heaviest, softest diffusion we normally use on the set is a cotton cloth called *muslin*.

Direction

The direction from which the key light comes at the actors is one of the most critical aspects of lighting. The most commonly used terminology is *front*, *3/4 front*, *side*, *3/4 back,* and *backlight*. The direction of the light is a major determinant not only of the shadows, but it is also an important factor in the mood and emotional tone of a shot. If most of the light comes from the side or back, the scene will tend to be "darker," more mysterious, more dramatic.

This is especially important if you are trying to make a scene appear underlit, such as a moody scene where you want the audience to perceive the scene as very dark. It is rarely a good idea to try to accomplish this effect by radically underexposing: a scene lit mostly from the back will appear dark without underexposing.

Avoid Flat Front Lighting

Flat front lighting occurs when the key light is very close to the camera. The result is an image with few if any shadows and very little depth or dimension. The result is an image that is very flat and without shape. Also, the subject is rarely separated from the background or other objects in the frame. This reminds us that one of the key jobs of lighting is to direct the eye and "pick out" key elements of the frame, usually the actors.

There are exceptions, of course, but as a general rule, flat front lighting is shapeless, dull, and boring. See Figure 7.11: the lighting is hardly better than the average driver's license photo. In Figure 7.12, the light has moved to the side and a *backlight* plus *kicker* is added. As a general principle, the more your key light comes from the sides or back, the more it is going to give the subject depth and dimension and serves as a positive element in the composition.

Figure 7.16. (top) This rig by Tony Nako for *X-Men* uses dozens of Kino-Flo units to create a soft overhead ambient light to suggest an overcast winter day.

Figure 7.17. (above) Overhead ambient light created with hand-made soft boxes. In this case the soft ambient is supplemented with hard light keys and other units for emphasis and shape.

Light from the Upstage Side

Particularly when lighting a dialog scene, it is almost always a good idea to light the actors from the *upstage side*. Upstage means the side away from the camera. If a key light is on the same side of the actors as the camera, it is *downstage*. It is not always possible, but whenever possible it is best to light from the upstage side. See Figures 7.13 and 7.14 for examples.

Backlight and Kicker

Two lights that by definition come from the back are *backlights* and *kickers*. Backlight is sometimes referred to as a *hair light* or *shoulder light* (Figure 7.12). It outlines the subject, separates them from the background, and gives the subject more shape and depth.

A *kicker* is a light that comes from 3/4 back and brushes along the cheek of the subject. It is an extremely useful light. Once you start looking for them, you will see kickers everywhere, even on simple interview shots. As cinematographers take advantage of the higher speed of new film stocks and HD cameras and their ability to "see" into the shadows, there is a tendency to use less and less fill light on subjects. The kicker can be useful to define the shadow side of the face even if there is no fill light at all. Men tend to benefit from a hard kicker, while a soft kicker frequently works better for women.

Intensity

How bright or intense a light is clearly affects exposure, but remember that no matter how bright or dark the overall light of a scene is (within limits), we can adjust it by exposing correctly with the iris, shutter, or neutral density filters. What is important here is the *relative intensity* of different lights within a scene, the relative *balance* of the various lights. These are really two completely different ways to think about the intensity and exposure of lighting in a scene: the

Figure 7.18. *Blown out* windows and strong contrast in the film *Domino*. All effects of this type depend on some smoke to make the light rays visible.

overall lighting level and then the *comparative difference* between lights in a scene — which is usually referred to as the *contrast ratio* between the *key* and *fill*.

Take a look at Figure 7.18 — the windows are completely *blown out*, meaning they are extremely overexposed. Most of the time, we try to control the windows so they are not overexposed and thus without detail and visually distracting in the frame. Occasionally the scene calls for a more extreme look and the DP will choose to blow out the windows. In this scene from *Domino,* the windows are not only blown out, but it is hard light and the slight haze in the room creates defined shafts.

Texture

Texture occurs in several ways. One is the inherent texture of the subject itself, but the one that concerns us here is texture of the light itself. This is done by putting things in front of the light to break it up and add some variation of light and shadow. Things you put in front of the light are called *gobos*, and a particular type of gobo is the *cuculoris* or *cookie*, which comes in two types.

Hard cookies are plywood with irregular cutouts (Figure 7.4). S*oft cookies* are wire mesh with a subtle pattern of translucent plastic.

Other tricks include putting a shadow-casting object in front of the light; traditionally these include things such as vertical *Charlie bars* — vertical wooden bars used to create shadows. This effect can also be accomplished with strips of tape on an empty frame. Another method is to put lace in a frame and place it in front of the light.

Color

Color is such a large and important issue that we devote an entire chapter to the subject. There are several aspects to the subject of color as we use it in filmmaking:

- The image-making side of color: how we use it to make better images.
- The storytelling aspect of color; that is the emotional cultural context of color. One of the best references on this topic is *If It's Purple, Someone's Gonna' Die*, by Patti Bellatoni, a fascinating and practical look at using color in filmmaking.
- Color is important at the camera (choice of film stock or proper video camera setup) and in terms of controlling color at the light source, which involves both using color-balancing gels and the choice of the proper lighting instruments, which come in both daylight balance and tungsten balance.

Figure 7.19. (top) This scene from *Kill Bill* is primarily lit from the practical source in the table.

Figure 7.20. (above) A practical table lamp used as a key in this scene from *The Big Combo*. Practical lamps figure prominently in the *film noir* genre.

BASIC LIGHTING TECHNIQUES

Lighting is a vast and complex subject; we don't have space here to go into great depth but, we can review some basic concepts. For a more comprehensive discussion of lighting, grip, and electrical distribution, see *Motion Picture and Video Lighting* by the same author, also a Focal Press book.

There are, of course, dozens of very different ways to light a scene. The incredible variety of lighting styles and techniques is what makes it a lifelong learning experience. First, some basic principals:

- Avoid flat front lighting. Lights that come more from the sides and back are usually the way to accomplish this. Any time a light is right beside or behind the camera, that is a warning sign of possible flat, featureless lighting.
- Use techniques such as backlight, kickers, and background/set lights to separate the actors from the backgrounds, accentuate the actor's features, and create a three-dimensional image.
- Be aware of the shadows and use them to create chiaroscuro, depth, shape the scene, and mood. Don't be afraid of shadows; some cinematographers say that "...the lights you don't turn on are as important as the ones you do turn on."
- Use lighting and exposure to have a full range of tones in the scene — this must take into account both the reflectances of the scene and the intensity of the lighting you put on them.
- Whenever possible, light people from the upstage side.
- When appropriate, add texture to your lights with gobos, cookies, and other methods.

Back Cross Keys

One of the most useful and commonly used techniques is *back cross keys*. It's simple, straightforward, and fast but also very effective. Take a look at the next ten dialog scenes you see in feature films, commercials, or television: there's a good chance that most or even all of them will be lit with this technique. (Figures 7.21 and 7.22)

The idea is simplicity itself. For a two-person dialog scene (which constitutes a large majority of scenes in most films), one upstage light serves as one actor's key light and also the second actor's backlight. A second light does the opposite: it is the second actor's key light and the first actor's backlight. That's all there is to it, but you may want to add some fill, backlights, or whatever else the scene calls for.

Figure 7.21 and 7.22. Two sides of scene lit with *back cross keys*: one light on each side is one actor's key and the other actor's backlight. Both lights are from the upstage side. In this case, the woman's key is coming through a window and some lace to add texture. His key is hard without any softening or texture. See the DVD or website for more on this lighting technique.

Ambient Plus Accents

Especially on larger sets, it is often difficult or impractical to light every corner of the set with many different hard or soft light units. It is often better to establish an *ambient base* — which means to simply fill the set with a soft, featureless overhead light. This gives you a basic exposure for the entire set, but it is usually somewhat bland and low in contrast. For some scenes, this might be the desired effect, such as this scene in a frozen landscape (Figures 7.16). In most cases, however, you will want to add some accents to feature actors or emphasize certain elements of the set (Figure 7.17). Establishing an ambient base can be accomplished in a number of ways:

- Overhead lights often in conjunction with an *overhead silk*
- *Chicken coops, space lights,* or *softboxes*
- Bouncing a light off the ceiling
- Leaving the overhead fluorescents on
- Large skylights or glass roof

Lighting with Practicals

This is a method that may be used by itself or in conjunction with other methods. A *practical* is something that works — whether it be a table lamp or a refrigerator. Here, we are only talking about lights, whether they be table lamps, sconces, floor lamps, or whatever.

Practical lamps play a part in almost any scene they are in, particularly if it is a night scene. The film noir genre in particular constantly used practical lamps as a major element in the frame as a lighting source.

One of the few absolute rules in lighting is that every practical must be on a dimmer of some sort. In most cases this will be a hand squeezer, a small hand-held dimmer that is usually made from an ordinary wall dimmer. The reason for this is obvious — with most kinds of lights, we can control the intensity with scrims, grip nets, neutral density gels, and flooding/spotting.

With practical lamps we don't have these methods of control, so a dimmer is the quickest and most precise way to control the brightness. One possible way to control a practical lamp is to precisely cut neutral density gel and fit it into the lampshade. This works, but it is time-consuming and crude. Given that these lamps appear in the frame, it is essential to be able to control them much more precisely than that, so hand squeezers are essential.

We want them to appear bright, or the lamp won't look like it's on. This means they are right on the edge — too bright and they will burn out, which means they are not only overexposed and without detail but they may also be a distraction in the composition.

Figure 7.23. Natural window light is extremely soft as long as there are no direct rays of the sun. It is not merely the light from the sky (a huge wrapping source), it is also the light bouncing off the ground, nearby buildings, and so on.

Lighting through the Window

In the old studio days, sets were commonly lit *from the grid* (overhead pipes). This is still done, but these days, locations are used as frequently as sets built in studios. On locations, it may be possible to rig a temporary grid of some sort through the use of various grip equipment such as *wall spreaders* or other means.

Also, locations are lit *from the floor*, meaning that lights are placed on stands. This works, but it has disadvantages, among them that the working area can be cluttered with stands, grip stands, and cable. For this reason, many DPs prefer to light from the outside — through window, doors, skylights, etc. This also has a naturalistic look almost by default; most rooms with windows naturally get a great deal of their light from the windows. Some cinematographers and gaffers go so far as to say always light from outside, although clearly there will be situations where this is not possible. This method also means that the set will be less crowded, so moving from setup to setup is quicker and easier and also gives the director much greater freedom in selecting their frame.

Available Natural Light

The term *available light* is used in two ways on film sets. One of them means whatever light is there in a location; usually an exterior location but it can refer to rooms that have windows, skylights, or ordinary room lighting as well. In general, the term "available light" means working with the existing lighting on the location. There is a third, less serious use of the term. Some might say that a particular DP is an "available light" cinematographer, as in "he uses every light available on the truck."

Figure 7.24. This dark, moody scene is lit primarily from the window with four *MaxiBrutes* through a 12x12 *Hilight* diffusion, supplemented by the library lamps on the table. A very slight smoke effect is added for atmosphere.

Available Light Windows

Window light can be some of the most beautiful light of all, if you use it right (Figure 7.23). Windows can be disastrous — for example, if you place an actor against a window and the camera is placed so that the actor is in front with the view out the window behind them. In normal daylight conditions, this will produce a very high-contrast situation, and you have to choose between having the outside view properly exposed and the actor in complete silhouette or exposing for the actor and having the window view overexposed and blown out. (See "The Window Problem" on the DVD or website).

There are work arounds, of course. One is to use a big light on the actor to bring up their exposure. This generally requires a very large unit and it can be difficult to make it look natural; also, the light has to be daylight balance. The other alternative is to bring down the exposure of the window. The easiest way to do this is to *gel* the window with *ND* (*neutral density* gel), which can reduce the light coming through the window by one, two, three, or even four stops (the ND designations for this are ND .3, .6, .9, and 1.2).

If you want to use tungsten balance lights inside the room, you can also add *85 gel*, which converts daylight (5600K) to tungsten balance (3200K). Or you can use gel that combines them: 85N3, 85N6, etc. But there is another alternative: change the shot. This not only makes lighting easier, but it will generally produce a better-looking shot. If the director is flexible about the staging, you'll get a better image by placing the camera so that the actor is beside the window and the background of the shot is no longer the view out the window, but rather something inside the room. This not only solves the exposure imbalance, but it also gives the actor soft window light from the side. This can be some of the most beautiful lighting there is.

What makes window light so beautifully soft? We have to distinguish between *window light*, *sky light*, and *sunlight*. Many people think of window light being "sunlight." Direct sun is hard and contrasty. *Sky light* is the light coming from the sky itself, which is a huge radiating source and thus very soft. Also coming through a window might be sun bounced off neighboring buildings, the ground, clouds, etc.

Figure 7.25. (top) For this re-creation of a noir look, his key is just a bounce off the paper in the typewriter.

Figure 7.26. (bottom) The overall setup is very simple: a *Tweenie* bounces off the typing paper, a *Betweenie* gives him a backlight/kicker, and another Betweenie adds a slight glow to the map. The practical lamps have very little influence on the scene; they are mostly just props.

MOTIVATED LIGHT

Light in a scene may come from many sources, including lights that are actually in the frame such as practicals, windows, skylights, signs, and so on. In some cases, these sources are visible but do not provide enough output for proper exposure. In this case, the sources may only serve to *motivate* additional lighting that is off-screen. Some cinematographers and directors prefer that most or all lighting in a scene be motivated in this way — that the viewer somehow understands where the light is coming from. In these frames from *Honeydripper* (Figures 7.29 and 7.30), the light is *motivated* by the lamps, but the actual illumination comes from sources not shown in the frame.

Figure 7.27. (top) Her only source is the practical lamp itself. A very small source adds a *catchlight* in the eyes.

Figure 7.28. (bottom) The lamp works for her even when she leans back, but only in a fairly narrow range of distance from the practical.

Carrying a Lamp

Often we want the lamp to appear to be lighting the subject, but for some reason, it just won't do it. If we turn the lamp's brightness up enough to light the actor, then the shade will be completely blown out; or it might be that the actor just isn't close enough to be properly lit by the lamps. In this case, we use a technique called *carrying* the lamp. To do this we set a small lamp in a place where it will hit

Figure 7.29. (top) In the establishing shot from *Honeydripper* the oil lamps are clearly shown to be the motivation for the direction, color, and softness of the light, which is then used to great effect in this two-shot.

Figure 7.30. (bottom) Once the sources have been established in the wide shot, the lighting of the mediums and close-ups makes sense and seems appropriate. This is an example of both *motivated lighting* and *carrying* a lamp.

the actor from the same direction as the light from the lamp. It also needs to be the same quality of hard or soft and the same color; table lamps tend to be on the warm side, often about 2800K or warmer.

Figures 7.25 and 7.26 show a modern take on a film noir look that employs a different method of carrying a lamp. Here the lighting is actually very simple: it's a Betweenie (300 watt Fresnel) that is bouncing off the piece of paper in the typewriter. Another *Betweenie* gives the actor a backlight, and a third one puts a small splash on the map behind him.

The typing paper bounce gives him a moody look appropriate for the scene and doesn't create problematic shadows like a hidden light from below would. If we try to light the actor with the practical

Figure 7.31. (top) If the practical is set high enough to give proper exposure to the subject, the lamp itself is completely blown out.

Figure 7.32. (middle) When the practical lamp is set to a level that gives it the proper exposure, then the subject is underexposed.

Figure 7.33. (bottom) A separate source is added to "carry" the lamp. It comes from the same direction as the lamp and gives the illusion that the practical lamp is lighting the actor. The source in this case is a MolePar in a snoot box with a dimmer.

lamp as in Figure 7.31, the lamp is totally blown out. If we dim it down enough to see the lamp (Figure 7.32), then the actor gets lost.

The solution was to have a light just out of frame on the left and below the table level. With this rig on a dimmer, it was possible to achieve the correct balance between the practical light and the actor's key. The key to this technique is to make sure the light you are using to carry the practical is hitting the actor from the same angle as would the light from the practical lamp. It needs to be the same color and quality (in terms of hard versus soft) as well.

DAY EXTERIORS

Working with daylight can be a lot trickier than people think. Some producer and directors believe that working with available daylight will always be faster and easier. Sometimes, but not always. If it's an overcast day (soft light), then nothing could be simpler.

If you are dealing with direct sun, however, controlling it can require constant attention and adjustment. When dealing with actors in direct sun, you have several choices: *diffusion* of the harsh sun, *filling* and *balancing* the shadows, finding a better location or angle for the shots, or moving the shot into *open shade*. See video examples on the DVD and website.

Fill

You can use *bounceboards* or lights to fill in the shadows and reduce the contrast. Grip *reflector boards* (Figure 7.34) have a *hard side* and a *soft side* and yokes with brakes so they can be set and will stay as positioned. The sun moves quickly, however, and it is almost always necessary to *shake them up* before each take. For this reason, a grip has to be stationed beside each board to re-aim it for each take. It is also important to *table* them if there is a break in filming. This means adjust the reflector to a horizontal position so it doesn't catch the wind and blow over. Be sure to secure them heavily with *sandbags*. Between scenes, they should be laid on the ground on their sides so as not to damage the surfaces.

Even the soft side of a reflector board can be a bit harsh; one good strategy is to aim the hard side through medium diffusion (like 216) or the soft side through light diffusion (such as Opal), which just smooths it out a bit.

Silks and Diffusion

Another choice is to make the sunlight softer and less contrasty. For tight shots, a 4x4 frame with diffusion can soften the light and can be held by a grip stand, with plenty of sandbags, of course. For larger shots, frames with silk or diffusion are made in many sizes: 6'x6', 8'x8', 12'x12', 20'x20' and even 20'x40'. These larger sizes require solid rigging and should only be done if you have an adequate grip crew who know what they are doing: a 12'x12' silk has enough area to drive a sailboat at 10 knots, meaning it can really do some damage if it gets away from you in a wind.

Open Shade and Garage Door Light

The simplest and often most beautiful solution to working with harsh direct sun is simply to get out of the sun entirely. If the director is flexible about the scene, it is usually not only faster but also better lighting to move the scene to a shady spot; best of all is *open shade*, which is the shady side of a building, trees, and so on, but open to the sky. Here the subject is lit by the soft light of the radiating sky dome, reflection off the rest of the terrain and so on. The only

Figure 7.34. This grip is standing by to *shake up* the *reflector board*. This means he re-aims it for every shot. The sun moves surprisingly fast and it is usually necessary to re-aim the reflector for nearly every take. This reflector board also has a layer of CTO gel on it to warm up the backlight.

danger here is your background: since the exposure will be a couple of stops down, it is critical that you not frame the shot so that the hot background behind the actor will be in direct sun and thus severely overexposed. (Figures 7.36 and 7.37).

A variation on this is *garage door light* (Figure 7.38). This is open shade with the darker interior as a background. It can be both beautiful and dramatic. It doesn't have to be an actual garage door, of course; the key is that it is open shade with a darker background such as you would have with an actor positioned right in a large open entrance such as a garage door. Also, a good deal of the light on the actor is being bounced off the surrounding landscape or buildings and also the ground level surface in front of them, which gives them a nice underlit fill. All of these methods are simply ways of dealing with the fact that sunlight is often too harsh and contrasty.

Sun as Backlight

If all other options are unavailable, an alternative is to turn the shot so that the actor has their back to the sun. This does two things: first of all the actor is lit by the bounce off the surroundings. In most cases this is not quite enough, but the addition of a simple bounce board (foamcore, beadboard, or a folding silk reflector) helps. This involves working with the director to adjust the shot. Remember that shots rarely exist on their own; they are usually part of an entire scene. This means that thinking it through and planning for the sun angles must be done before starting to shoot the scene. Once you have shot the master for a scene, it is often not possible to cheat the actors around to take advantage of the sun's position, although for some close-ups it may be possible. It is also important to think ahead about the sun's movement, especially if the scene is going to take a long time to shoot or there is a lunch break during filming.

Figure 7.35. The grips are *Hollywooding* a light silk to move with the actors for the dolly shot. Hollywooding is a term for handholding a silk, light, or flag.

LIGHTING FOR HIGH DEF VIDEO

High Def is much closer to film than non-High Def video but there are still differences. It tends to *see into the shadows* more than film, and it sees detail much more than film. This means that shadows you would expect to go black or nearly black in film are still visible in HD. This can have the effect of ruining the illusion; the same is true of HD's tendency to see more fine detail. The makeup and wardrobe departments must be especially on their toes. Tiny imperfections of sets and props can suddenly become obtrusive where on film they were more than acceptable. This is a big part of the "video look," which, while far less apparent on High Def, can still be a problem if not dealt with properly. This problem is more complex than just detail resolution: it can be partially dealt with by using diffusion filters but by no means entirely. Dealing with it in this way may mean using diffusion filters where you don't want to.

The idea that HD requires less lighting is a bit of a myth. However, it is true that because HD cameras can shoot at higher ISOs without unacceptable noise, then lighting for HD cameras often calls for less intensity of lighting. This means that you can use a 5K where a 10K might have been necessary for film lighting. How many lights you use is based on shaping the light, accenting certain elements, and so on. Between film and video, the number of lights seldom changes, but their size often does. This is because high-definition video *sees* into the shadows a great deal more and thus give the impression of being *faster* than film. This is much the same as happened with the introduction of high-speed lenses and high-speed film in the 80's and 90's. Overenthusiastic supporters claimed that fewer people would be needed on the crew and fewer lights. None of this is true in the

Figure 7.36. (top) Direct sunlight is harsh, contrasty, and unflattering. If you do have to shoot in direct sun, try not to do so during the middle part of the day. Sunlight is softer and at a lower, more flattering angle early in the day or late in the afternoon.

Figure 7.37. (bottom) Here we just have the actor back up a few feet so he is under the awning of the building. This is *open shade;* it is softer and less contrasty.

larger sense, of course — not if you really care about the quality of your lighting. At best, you need a smaller generator and lighter gauge distribution cable and slightly smaller lights.

Think of it this way — say you light a scene beautifully with four lights: a 12K creating a beautiful shaft of light through the window, a 10K raking down the hallway, a 2K bounce for a key on the scene, and a baby-junior for a backlight. Let's now assume that the speed of your video camera *doubles* (a very big jump in speed). Does this mean that you all of a sudden need fewer lights?

Not unless you want to do less lighting — that is, give up something important. You still need four lights to accomplish what you did before. The only difference is that instead of a 12K you need a 6K, instead of a 10K you can use a 5K, and so on. Doubling the speed is a giant leap technologically, but in terms of exposure and lighting it is only one stop. Can you get an exposure using fewer lights? Of course you can. But as a cinematographer or director, if you are willing to say that *just* getting an exposure is your only goal

Figure 7.38. An example of *garage door light*. The subject is just inside the door, which puts her in open shade. The sun is still hitting the ground, buildings and the rest of the background behind the camera, which results in a soft bounce on the actress.

in lighting, then you don't need to be reading books like this one. It is true that there are more and more cases where you can shoot purely with *available* light — that is, where you can get visually interesting, even beautiful scenes only with the light that already exists at a location. However, this is not a high def or even a video phenomenon, the same is true with film stock, which has improved vastly in the last few years. For example, look at the movie *Lost in Translation*, in which nearly all of the night exteriors of Tokyo were shot purely with available light.

lighting sources

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Figure 8.2. (above) A *12K HMI Fresnel*.

Figure 8.1. (previous page) An *Airstar* balloon light used for a large night exterior.

THE TOOLS OF LIGHTING

Cinematographers do not need to know all the details of how each piece of lighting equipment works, but it is essential that they know the capabilities and possibilities of each unit, as well as its limitations. A great deal of time can be wasted by using a light or piece of grip equipment that is inappropriate for the job. One of the DPs most important functions is ordering the right lighting equipment for the job and using it appropriately. Motion picture lights fall into seven general categories: *HMIs*, tungsten *Fresnels*, tungsten *open face lights*, *fluorescents*, *xenons*, *practicals*, *LED* lights, and *sunguns*.

DAYLIGHT SOURCES

Lighting units can generally be divided into those that output *daylight balance* or *tungsten balance* light. Several types of light are daylight balance: HMIs and *color correct fluorescents* and LED units among them.

Color Rendering Index

Lights are classified according to *Color Rendering Index* (CRI), which is a measure of the ability of a light source to reproduce the colors of various objects faithfully in comparison with a natural light source. This means that a light with a low CRI will not render colors accurately. A CRI of 90 or above (on a scale of 0 to 100) is considered necessary for film and video work (and also still photography). The CRI is especially important when judging fluorescent and other gas discharge sources. For most HMIs and color-correct fluorescents, LEDs, and other units designed for film work, the color rendering index is greater than 90.

HMI Units

HMIs generate three to four times the light of tungsten halogen, but consume up to 75% less energy for the same output. When a tungsten bulb is color-corrected to match daylight, the advantage increases to seven times because a great deal of the spectrum is absorbed by the blue gel (color temperature blue or CTB). See the chapter *Color*). Because HMIs (Figure 8.2) are more efficient in converting power to light, they generate less heat than a tungsten lamp with the same output.

HMI stands for the basic components: H is from the Latin symbol for mercury (Hg), which is used primarily to create the lamp voltage. M is for medium-arc. I stands for iodine and bromine, which are halogen compounds. The halogen serves much the same function as in a tungsten halogen lamp in prolonging the useful life of the bulb and ensures that the rare earth metals remain concentrated in the hot zone of the arc.

HMI lamps have two electrodes made from tungsten, which project into a discharge chamber. Unlike tungsten bulbs, which have a continuous filament of tungsten wire, HMIs create an electrical arc that jumps from one electrode to another and generate light and heat in the process. *Color temperature (*see the chapter *Color)* as it is measured for tungsten bulbs or sunlight does not technically apply to HMIs (or to other types of discharge lighting such as fluorescents) because they produce a quasi-continuous spectrum. In actual practice, though, the same measurements and color temperature meters are used for all types of video and motion picture lighting sources.

Our eyes are unreliable in judging color because our brain adjusts and compensates; it will tell us that a wide variety of colors are "white." A *color meter* or *vectorscope* is a far more dependable ways of judging color; however, they do not measure CRI.

Figure 8.3. A combination of *Kino Flo* and tungsten units on a *blue-screen* efx set. (Photo courtesy of Kino Flo.)

Ballasts

All HMIs require a ballast, which acts as a current limiter. The reason for this is simple: an arc is basically a dead short; if the current were allowed to flow freely, the circuit would overload and either blow the fuse or burn up. Early ballasts for HMIs were extremely heavy and bulky (200 pounds or more) because they contained current limiters that consisted of heavy copper wire wound in a coil like a transformer. Fortunately, few of these remain in use.

The invention of the smaller and lighter electronic ballast was a major improvement. Electronic ballasts also allow the unit to operate on a *square-wave* (unlike the *sine wave* of normal alternating current electricity).

The most significant new development in HMIs is the new *flicker-free* ballasts, which use square-wave technology to provide flicker-less shooting at any frame rate. With some units there is a penalty paid for flicker-free shooting at frame rates other than sync sound speed: it results in a significantly higher noise level. If the ballasts can be placed outside or shooting is MOS, this is not a problem. It is not usually an issue as high-speed shooting rarely involves recording audio. For a more detailed discussion of flicker and how to avoid it, see the chapter *Technical Issues*.

Header cables are the power connection from the ballast to the light head itself. Many larger HMIs can only take two header cables; a third header will usually result in a voltage loss too great to get the lamp to fire up. *Square-wave* refers to the shape of the sine wave of the alternating current after it has been reshaped by the electronics of the ballast. Flicker is discussed in more detail in the chapter on

Figure 8.4. (above) The ballast acts as a transformer to provide operating voltage and also starting voltage, which can be as high as 20,000 volts. It is also a current limiter.

Figure 8.5. (right) An 18K HMI with a *Chimera softbox* in use on a day exterior location.

Technical Issues, but suffice it to say here that the normal sine wave of AC current leaves too many "gaps" in the light output that become visible if the camera shutter is not synchronized to its rhythm. By squaring the wave, these gaps are minimized and there is less chance of flicker. This is especially important if you are shooting at anything other than normal speed; high-speed photography in particular will create problems. It is important to note that flicker can be a problem in video also, just as with film cameras.

Voltages as high as 12,000 *VAC* (volts AC) or more are needed to start the arc, which is provided by a separate ignitor circuit in the ballast. This creates the power needed for the electric current to jump across the gap between the two electrodes. The typical operating voltage is around 200V. When a lamp is already hot, much higher voltages are needed in order to ionize the pressurized gap between the electrodes. This can be from 20 kV to more than 65 kV (kiloVolt). For this reason, some HMIs can not be restruck while they are hot — which means you may have to wait for the light to cool before you can start it again. This can be a major hindrance when the whole film crew is waiting on it. *Hot restrike*, which generates a higher voltage to overcome this resistance, is a feature on most newer HMIs. HMI bulbs can change color temperature as they age. It is important to check the color temperature of HMI bulbs periodically with a color meter to see if they need correcting gels to keep them consistent with other lighting units in use on the project.

18K and 12K HMI

The 18K and the 12K HMIs are the most powerful fresnel lights currently available. Like all HMIs they are extremely efficient in light output per watt of input power. They produce a sharp, clean light, which is the result of having a very small source (the gas arc) which is focused through a very large lens (Figure 8.2).

These large lights are invaluable where very large areas are being covered or there is a need for high light levels for high-speed shooting. They are also a natural for sunlight effects such as sunbeams through a window or any other situation where a strong well-defined beam is needed. They are also among the few sources (along with HMI PARs) that will balance daylight and fill in the shadows sufficiently to permit shooting in the bare sun without silks or reflec-

Figure 8.6. Larry Mole Parker of Mole-Richardson does a side-by-side test of a *carbon arc* light and a *12K HMI PAR*.

tors. The fact that they burn approximately "daylight blue" (5500 degrees kelvin) is a tremendous advantage in these situations: no light is lost to filters. Often when a 12K or 18K is used to fill in sunlight, it is the only unit operating on a generator. If it was drawing on one leg only, the load would be impossible to balance and might very well damage the generator. In this case a *ghost load* on the other legs is necessary.

Most 12 and 18Ks are 220 volt lights, but some are 110 volt units which can make load balancing difficult. Lights that run on 220 volts require *three-phase* power. Most power available on a movie set, or in most buildings, is 110 volts in the United States. In Europe, Great Britain, and most of the rest of the world, 220 volt power is the standard. For more on electricity and power supplies for lighting, see *Motion Picture and Video Lighting*, also from Focal Press.

As with any large light, coordinate with the *gennie* (generator) operator before firing it up or shutting it down. The power surge when they start up can be a significant strain on the power supply. Don't start up all the large lights at the same time. Be sure to clarify with the rental house what type of power connectors are used on the lights when you are placing your lighting and grip order for the job.

6K & 8K

6K and 8K HMIs can handle many of the same jobs as the bigger lights, particularly where the area covered is smaller. Although they generally have a smaller lens, they still produce a sharp, clean beam with good spread. In many applications they perform admirably as the main light: serving as key, window light, sun balance, and so on. Some 6Ks and 8Ks accept 110 volt input and, some require a 220 volt power supply. They may require a variety of connectors or a set of *Siamese splitters, (*called Y-cords in Great Britain).

When ordering any large lamp, it is crucial to ask these questions and be sure the rental house will provide the appropriate distribution equipment or adapters — remember, if you don't order it, it won't be there. You must be very thorough when placing an order. Failure to do so may result in the light not being functional. Some makes of HMIs provide for head balancing. This is accomplished by sliding the yoke support backwards or forwards on the head. This is a useful feature when adding or subtracting barn doors, frames, or other items that alter the balance of light.

Figure 8.7. *Lite Panel LED* lights mounted in a car and also as a fill light on the camera. This type of camera mounted fill light is called an *Obie*, named for actress Merle Oberon, for whom it was invented. Due to their light weight, compact size and, ability to run off batteries, LED units are very popular as camera mounted lights. (Photo courtesy of Litepanels.)

4K and 2.5K

The smaller HMIs, the 4K and 2.5K, are general purpose lights, doing much of the work that used to be assigned to 5K and 10K tungsten lights. Slightly smaller than the bigger HMIs, they can be easily flown and rigged and will fit in some fairly tight spots.

1.2K and Smaller Units

The smallest lamps, the 1.2K, 575, 400, and 200 watt HMIs, are versatile units. Lightweight and fairly compact, they can be used in a variety of situations. The electronics ballasts for the small units have become portable enough to be hidden in places where larger units might be visible. They can also be *wall-plugged*, which means no generator or other supplemental power supply is needed on location.

HMI PAR Units

Some of the most powerful, intense lights available are HMI PARs; they have the high output of HMIs and the tightly focused beam of the PAR reflector. The largest units are 12K and 18K, but HMI PARS are made in smaller sizes as well, down to 125 watts. *Arri Lighting* (part of the *Arriflex* group) makes a popular unit called the *Pocket PAR* in these smaller sizes.

One particularly versatile unit is the 1.2K HMI PAR, made by several manufacturers. What makes it special is that it is small enough (in wattage) to be plugged into a 20 amp household circuit, but being PARs they have a healthy output, which in conjunction with their daylight balance means they have a wide variety of uses in daylight situations: fill when bounced or through diffusion or for a small shaft of light through a window.

Rules for Using HMI Units

- Check the stand and ballast with a VOM meter for leakage by measuring the voltage between the stand and any ground. There will usually be a few volts, but anything above 10 or 15 volts indicates a potential problem.
- Keep the ballast dry. On wet ground, use apple boxes, rubber mats or other insulation material.
- Avoid getting dirt or finger marks on the lamps: oil from the skin will degrade the glass and create a potential failure point. Many lamps come provided with a special cleaning cloth.
- Ensure that there is good contact between the lamp base and

the holder. Contamination will increase resistance and impair proper cooling.

- The filling tip (nipple) should always be above the discharge, or there is a risk of a cold spot developing inside the discharge chamber.
- Running at above rated voltage may result in failure.
- Very long cable runs may reduce the voltage to a point that affects the output and may result in the lamp not firing.
- Excessive cooling or direct airflow on the lamp may cool the lamp below its operating temperature, which can result in a light with a high color temperature and inferior CRI.

Potential Problems

HMIs (or any light with a ballast) may sometimes fail to function properly. Be sure to have a few extra header cables on hand: they are the most common cause of malfunctions. The safety switch on the lens can also cause trouble. Never try to bypass it, however; it serves an important function. HMIs should never be operated without the glass lens, which filters out harmful ultraviolet radiation that can damage someone's eyes. When they do fail to fire:

- Check that the breakers are on. Some HMIs have more than one breaker.
- *After* killing the power, open the lens and check the microswitch that contacts the lens housing. Make sure it is operating properly and making contact. Wiggle it, but don't be violent — the light won't operate without it.
- If that fails, try another header cable. If you are running more than one header to a light, disconnect and try each one individually. Look for broken pins, dirt in the receptacle, etc.
- Check the power. HMIs won't fire if the voltage is low. Generally they need at least 108 volts to fire. Some have a voltage switch (110, 120, 220); be sure it's in the right position.
- Try the head with a different ballast and vice-versa.
- Let the light cool. Many lights won't do a hot restrike.

XENONS

Xenons are similar to HMIs since they are a gas discharge arc with a ballast. They feature a polished parabolic reflector that gives them amazing throw and almost laser-like beam collimation. At full spot they can project a tight beam several blocks with a relatively small amount of spread. Xenons are very efficient with the highest lumens per watt output of any light. Xenons currently come in five sizes: a 1K, 2K, 4K, 7K and 10K. There is also a 75 watt sun-gun unit. The 1K and 2K units come in 110 and 220 volt models, some of which can be wall-plugged. This produces a high-output light that can be plugged into a wall outlet or a small portable generator. Larger xenons are extremely powerful, and must be used cautiously: they can quickly crack a window. Just one example of their power: with ASA 320 film stock and the light set at full spot, a 4K delivers f/64 at 40 feet from the light, considerably more than you would get with a 4K HMI or equivalent tungsten lamp.

The current supplied by the ballast to the bulb is pulsed DC; as a result, flicker is not a problem for xenons, and they can be used for high-speed filming up to 10,000 fps. Xenons do, however, have some disadvantages: all xenons are expensive to rent and have a cooling fan that makes them very difficult to use in sound filming. Also,

Figure 8.8. A 20K Fresnel tungsten. (Photo courtesy of Cinemills.)

Figure 8.9. A Mole-Richardson *Baby Baby* 1K. This is a 1,000 watt tungsten Fresnel. It is a "baby" for two reasons: a 1K Fresnel is called a baby, but this is also the baby version of that as it is smaller than a studio 1K.

Figure 8.10. A scrim set for a Betweenie. Most lights come with a scrim set to control intensity. A *double* (red rim) reduces the output by one stop, and a *single* (green rim) reduces it by one-half stop. Also included are a *half-double* and a *half-single*. This is called a *Hollywood scrim set* because it includes two doubles.

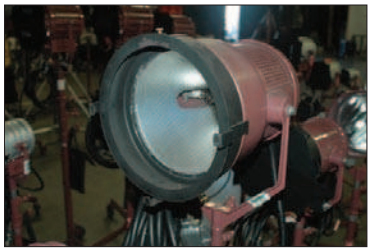


Figure 8.11. (top) The Mole-Richardson open face 2K or *Mighty Mole*.

Figure 8.12. (middle) A 1K *MolePar*.

Figure 8.13. (bottom) A *Big Eye* 10K, so called because it has a lens that is larger than a standard studio 10K.

because of the bulb placement and reflector design, there is always a hole in the middle of the round beam, which can be minimized but never entirely eliminated.

Due to the parabolic reflectors, flagging and cutting are difficult close to the light: flags cast bizarre symmetrical shadows. Also, the extremely high and concentrated output means that they burn through gel very quickly. Many people try to compensate by placing the gel as far as possible from the light. This is a mistake — the safest place to gel is actually right on the face of the light.

Seventy-five watt xenon sunguns were developed for the Navy. They are excellent for flashlight effects. They come in both AC and DC configurations. Most have motorized flood /spot controls that can be operated during the shot. As with larger xenons, there is a hole or a hot spot in the center of the beam (depending on the focus) that cannot be eliminated. Xenon bulbs do not shift in temperature as they age or as voltage shifts.

LED Lights

A new and very popular source is LED lights (Figure 8.7), which are small and extremely energy efficient, which also means that they produce much less heat than tungsten lights (where the electricity produces 90% heat and only 10% light). LEDs have been incorporated into all types of units, although few of them have the long reach of a PAR or a fresnel. For lighting fairly close to the scene, however, they have many advantages. Their compact size means they can be hidden in many places on the set and also makes them easier to handle and rig on location. There are also many LED lights that run on batteries — these can be very useful for handheld work, camera mounting and other conditions where AC power may not be available or it is just not practical to run and AC power cord. Certainly a hand-held camera operator is not going to want to be dragging a power cable around all the time.

TUNGSTEN LIGHTS

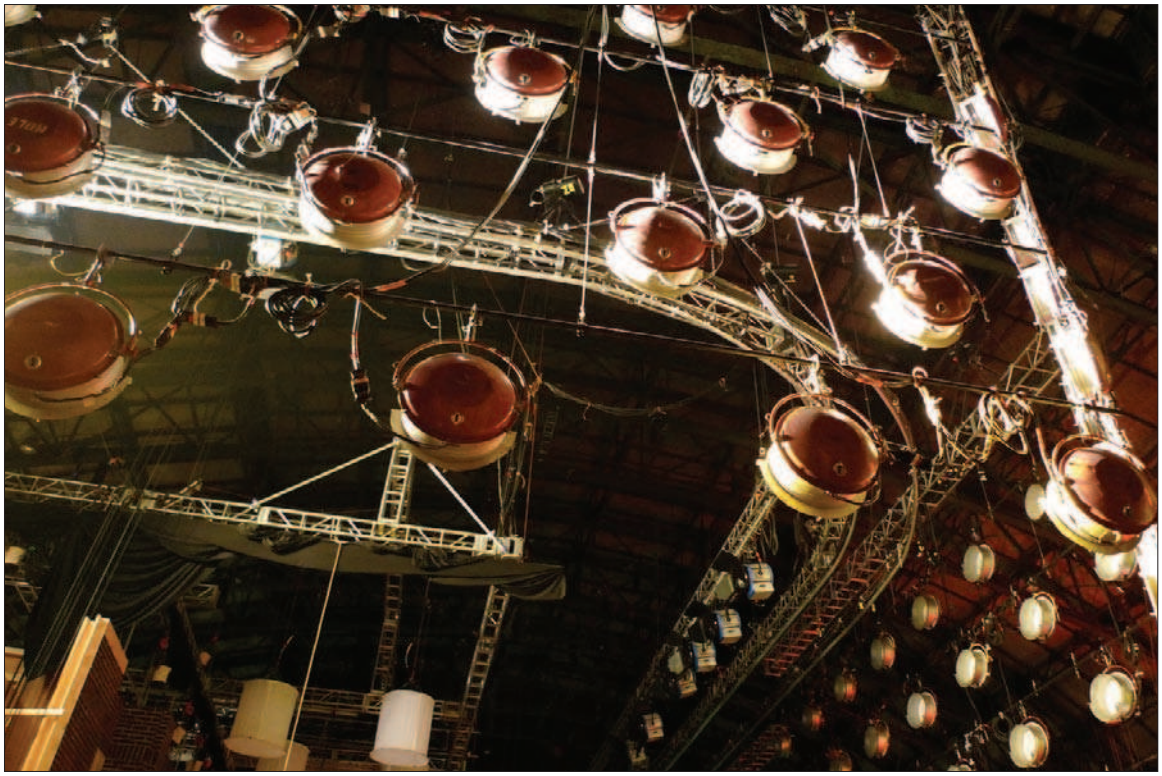
Tungsten lamps are just bigger versions of ordinary household bulbs; they all have a filament of tungsten wire just as invented by Thomas Edison. There are two types of tungsten fresnels: *studio* and *baby*. The *studio* light is the full-size unit, and the *baby* is a smaller housing and lens, making it more compact for location use (Figure 8.9). As a rule, the baby version is the studio housing of the next smaller size (the body of a baby 5K is similar to the body of a studio 2K). In most countries outside the United States, the electrical supply is 220 volts; different bulbs are used that are suited to the appropriate voltage.

Fresnels

Fresnel units are lights with lenses. Most film lights employ the stepped Fresnel type lens, with a few exceptions that use a simpler *plano-convex* lens such as a *Dedo* or an *ellipsoidal* (*Leko*). A Fresnel lens is a stepped ring design that reduces the thickness of the lens to save on cost and also prevent heat buildup in the glass, which can cause cracking.

Twenty

The biggest tungsten light now in use is the 20K. It is a large unit with tremendous output. Many jobs that were formerly done by the 10K are now done with this light. Most 20K units use bulbs that run at 220 volts (which may require special electrical distribution), and several models come with a built-in dimmer (Figure 8.8).



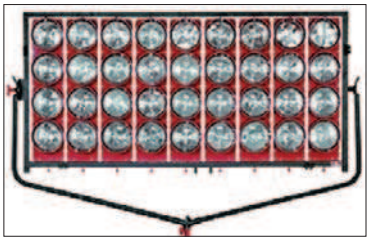


Figure 8.14. (above) The *Dino*, or in this illustration, Mole-Richardson's *Moleeno*, consists of 36 1K PAR bulbs. (Photo courtesy of Mole-Richardson.)

Figure 8.15. (top) *Skypans* rigged for a large set by lighting director Tony Nako and gaffer Michael Gallart. Skypans are very simple lights — just a socket for the bulb and a pan reflector. They can use 5K, 10K or 20K bulbs. Also on the trusses are 5K Fresnels and space lights. (Photo by Michael Gallart).

Tenners

The 10K tungsten Fresnel comes in three basic versions:

- The baby 10K provides high-intensity output with a fairly compact, easily transportable unit with a 14-inch Fresnel lens.
- The basic 10K, known as a "tenner" or studio 10K, has a 20-inch Fresnel.
- The largest light of this group is the *Big Eye* tenner, which has a 24-inch lens. The Big Eye is a very special light with quality all its own. The DTY (10K) bulb provides a fairly small source, while the extremely large fresnel is a large radiator. The result is a sharp, hard light with real bite but with a wraparound quality that gives it almost a soft light quality on subjects close to the light. This is a characteristic of all very big lights that gives them a unique quality.

It is important to never use a 20K, 10K, or a 5K pointing straight up (this applies to large HMIs and xenons as well). The lens blocks proper ventilation and the unit will overheat. Also, the filament will not be properly supported and will sag and possibly touch the glass.

Senior/5K

Although it is available in both versions, the *baby 5K* is far more popular than the larger unit. It can work as a general purpose big light and a fill used against a 10K. The 5K is also called a *senior*.

Junior/2K

The *2K Fresnel* is also known as a *deuce* or a *junior*. It has enough power to bring a single subject or actor up to a reasonable exposure, even with diffusion in front of the lens. Juniors are also useful as backlights, rims, and kickers. *Baby juniors* (called *BJs*) are the more compact and an extraordinarily versatile unit.

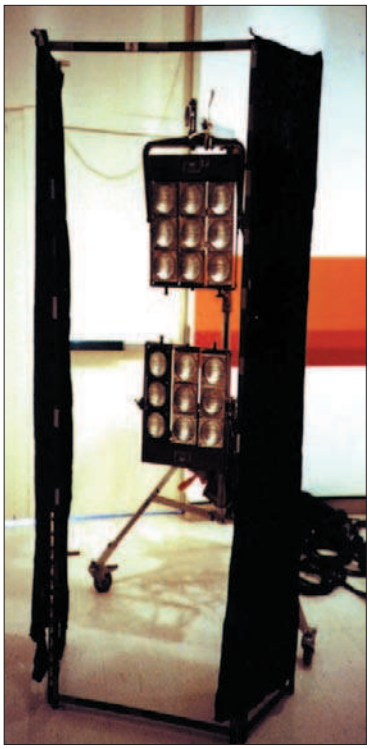


Figure 8.16. (left) The *Ruby Seven*, a PAR based unit that offers additional controllability. (Photo courtesy of Luminaria.)

Figure 8.17. (above) Two *Mole FAY* lights *boxed in* with some 4x8 floppies for control.

Baby/1K

Thousand watt units are known as *1Ks* (one K) or *babies*. The 1K is used as a key light, a splash on the wall, a small back light, a hard fill, and for dozens of other uses. The baby can use either a 750 watt bulb (EGR) or a 1,000 watt bulb (EGT). Most are now used with the 1K quartz bulb, but are still called 750s. The *Baby 1K*, also called a *Baby Baby*, is the small size version. Because of its smaller lens and box, it has a wider spread than the studio baby.

Tweenie /650

The *Tweenie* is "between" the 1K and the Inky. With the new high-speed films, the Tweenie is often just the right light for the small jobs a baby used to do, even as a key light. It is very useful for a number of small jobs, easily hidden, and can function as a quick accent or an eyesight.

Betweenie, InBetweenie, Inky and Pepper

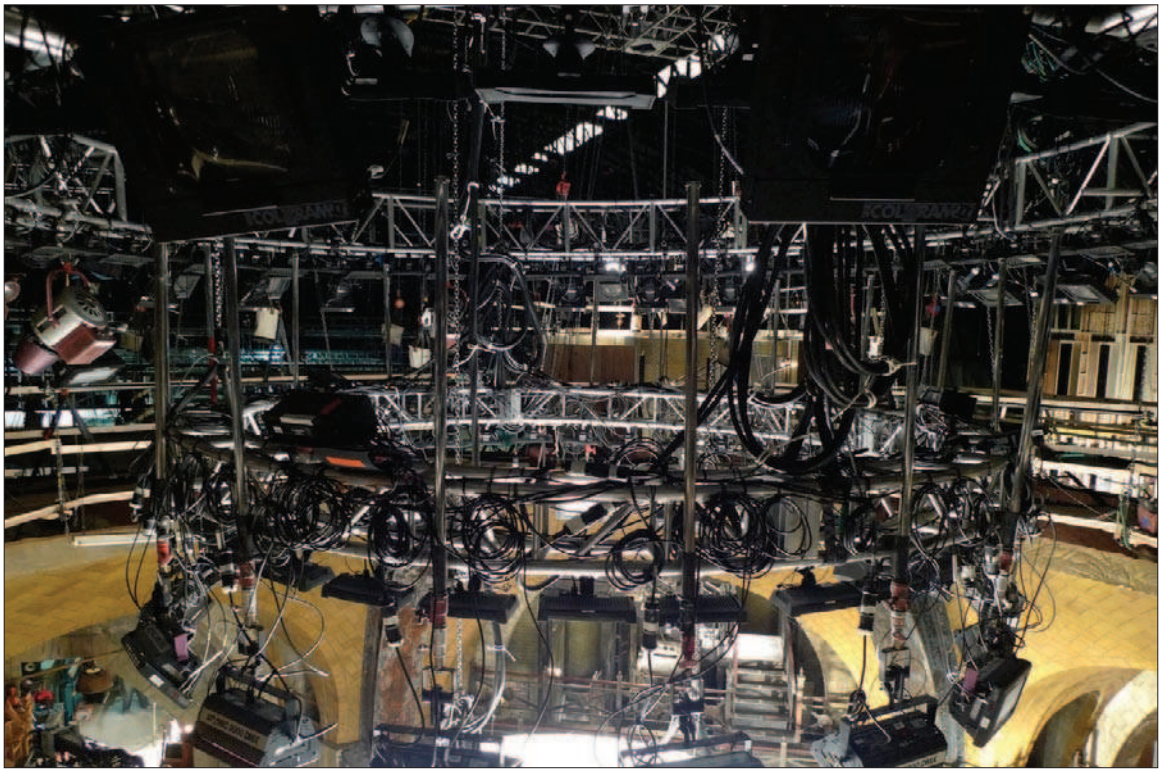
These are similar to Tweenies but smaller. The *Betweenie* is a 300 watt unit and the *InBetweenie* uses a 200 watt bulb and is often used instead of an *Inky* (also 200 watts). At 100, 200, or 300 watts (depending on the bulb and size of the housing), the *Pepper* is a smaller unit, but up close it can deliver a surprising amount of light. The Inky at 200 watts is great for a tiny spritz of light on the set, as an eye light, a small fill, or for an emergency last-minute light to just raise the exposure a bit on a small area.

Open Face

Some 2K, 1K, and 650 units are available as *open face* lights — that is, they have no lenses, but they do have some spot/flood focusing. Their light is raw and can be uneven, but they do have a tremendous output for their size. They are good for bounce or shooting through diffusion (Figure 8.11). They are a good source when all you need is raw power and the control that a Fresnel affords isn't necessary.

PARS

PAR stands for *parabolic aluminized reflector*. A parabola is an ideal shape to collect all of the light rays and projects them out in the same direction. It is the shape of reflector that is going to give the narrowest, most concentrated beam. In conjunction with this, all PAR units have a lens, which functions primarily to concentrate or spread the beam. Tungsten parts generally come with a fixed lens that is part of the unit: they are pretty much the same as a car headlight. HMI PARs always come with a set of interchangeable lenses: these



go from a very wide beam to a very narrow beam. The disadvantage of PARs is that the beam generally covers only a very small area and is not a very complimentary light for actors because it tends to be uneven and raw; nor is it easily controllable, but it is useful for many purposes that call for just raw light power.

PARs come in two basic varieties: film versions come in a solid rotatable housing such as Mole-Richardson's *MolePar* (Figure 8.12), which feature barn doors and scrim holders, and in a flimsier theatrical version called a PAR can. Theatrical lights are not generally as sturdily built because they are generally hung in a theater and then left alone. They don't get the rough treatment and adverse conditions that film and video lights do. PARs (especially the very concentrated NSP bulbs) can quickly burn through even the toughest gels, melt bead board, and set muslin diffusion on fire.

PARs with a *dichroic* coating have an output that is very close to daylight (blue) balance. Small PAR 48s and 36s are also available at lower voltages, as well as 110 volt. Nearly all types of bulbs are also available in 220 volts. As single units, they may be used in units such as the PARcan or MolePAR. PARcans are used extensively in concert lighting; they are lightweight and inexpensive. The MolePAR is more rugged and better suited to work on a film set.

PAR Groups

PARs are also made in groups, one of the best known being the *Maxi Brute*, a powerful unit with tremendous punch and throw. They are used in large night exteriors and in large-scale interior applications: aircraft hangars, arenas, and so on. They can also be used directly or through gel, muslin, and so on, when very high light levels are needed to get through heavy diffusion. All PARs generate very intense and concentrated heat; use caution when setting them up — they can crack windows and char wood and other materials.

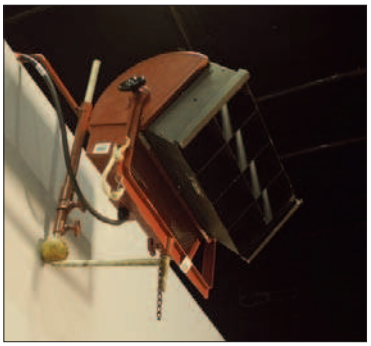


Figure 8.18. (above) A Mole-Richardson *2K Zip Softlight*. *Zip* means it is more compact than a regular softlight. It is mounted on a *set hanger* (also called *wall hanger*). 2K Zips are very popular for just this sort of use: they fit into small spaces and when put up near the ceilling of a set or location, they don't hang down so far that they interfere with the shot.

Figure 8.19. (top) A complex rig supporting a variety of lights. The middle ring holds 108 lights from LED units to strobes to Mole 5K tungsten Fresnels. Also hanging from this rig are space lights including one very large space light — see Figure 8.24. (Photo by Michael Gallart.)

Figure 8.20. A Mole-Richardson *6K HMI PAR* unit.

MaxiBrutes and *Dinos* are similar in design but different in size. Maxi's come in configurations of 6, 9, or 12 x PAR 64 lamps, the most common being the 9 lamp head. A *Dino* or *Moleeno* is 36 x PAR 64 lamps. Other variations of this design exist as well (Figure 8.14).

Fay lights are clusters of 650 watt PAR 36s and come in configurations up to 9 or 12 lamps. *Wendy lights,* developed by cinematographer David Watkin, come in large panels with the same PAR 36 lamps (usually DWE). Vittorio Storaro has also developed a series of lights that use 28 volt *ACL* bulbs (*Aircraft Landing Lights*).

All the bulbs on most multi-PARs are individually switchable, which makes for very simple intensity control. All PAR group lights allow for spot, medium, and flood bulbs to be interchanged for different coverages. The FAY bulbs are dichroic daylight bulbs; tungsten bulbs (FCX) can also be used. They can be used as daylight fill in place of HMIs. They are not exactly daylight balance but are very close to and can be corrected with gels if necessary.

Most people refer to any PAR 36 dichroic bulb as a FAY, but in fact there are several types. FAY is the ANSI code for a 650 watt PAR36 dichroic daylight bulb with ferrule contacts. If the bulb has screw terminals, it is an FBE/FGK. With diffusion these units can be used as a large-source soft light (Figure 8.17).

The Ruby

Multi-PAR units are an outstanding source of raw *firepower*. They provide a lot of output per watt that can be concentrated into a small area or flooded with some degree of precision. Multi-PAR units also tend to be less expensive to rent than large Fresnel lights.

Although with some units you can swivel the outside banks of lights inward or outward, it is not possible to truly *spot* them. The *Ruby Seven* solves this with a mechanism that tilts the outer ring in or out, moving on the axis of the center bulb (Figure 8.16).

HMI PARs

HMI PARs are available from 18K and 12K down to 1.2K, 575s, 200s, and even smaller. The larger units are extremely powerful. The smaller ones can be moved easily, where moving a scaffold and heavy light is a major operation. HMI PARs are different from tungsten units in that they have changeable lenses that can be added to make a narrow spot, a medium flood, wide flood, and an extra-wide flood. Every HMI PAR will come with its own set of lenses. As with tungsten PARs, the beam is oval and the separate lenses can be rotated to orient the pattern.

SOFT LIGHTS

Studio soft lights consist of one or more 1,000 watt or 1,500 watt bulbs directed into a *clamshell* white painted reflector that bounces light in a random pattern, making a light which is apparently as large as the front opening. They vary from the 1K studio soft (the Baby soft, also known as a 750 soft) up to the powerful *8K Studio Soft*, which has eight individually switchable bulbs.

All soft lights have certain basic problems: they are extremely inefficient in light output; they are bulky and hard to transport; and like all soft sources, they are difficult to control. While the large reflector does make the light "soft," the random bounce pattern makes the light still somewhat raw and unpleasant.

As a result of this rawness, some people put some diffusion over the soft light for any close-up work. Big *studio softs* through a large frame of 216 is a quick way to create a large soft source in the studio. Often

Figure 8.21. (top) *Barger Baglights* with Chimera softboxes in use on a hair product commercial. The reason there are so many lights is that they are dimmed up and down for different shots or when the model moves. Also, since this is a hair commercial, light coming from any directions makes for more reflections and sheen on the hair so it looks its best. This is a key advantage of tungsten lights: they can be controlled from a dimmer board. In comparison to a 5K with a Chimera, the Bargers have wider, more even throw and take up less real estate on the set.

Figure 8.22. (bottom) A reverse angle of the scene; DP Tom Denove is taking an incident reading at the model's position and using his other hand to shield the backlights from influencing the reading: this is correct procedure for taking an incident reading, which is the reading that determines what f/stop the lens will be set at. In most cases you don't want the backlight to influence that reading.

used with the studio is the *egg-crate*, which minimizes side spill and does make the beam a bit more controllable. Soft lights see most of their use in television studios where they provide a soft source without additional rigging. However, tungsten softlights in television news studios have been almost entirely replaced by Kino Flo units for one simple reason: to save on air conditioning costs. The color-correct fluorescent lights generate substantially less heat, which can be a real problem for studios, where they might be in use 24 hours a day. Since they are more or less permanently flown, their bulkiness is not a problem.

Small compact versions of the 2K and 1K soft lights are called zip lights (Figure 8.18). They have the same width but half the height of a soft light of similar wattage. Because of their compactness, zips are great for slipping into tight spaces.

Barger Baglights

Barger makes a type of softlight that is compact and efficient; it consists of several 1K tubular bulbs in a housing. It is always used with a *Chimera*, which is a self-contained softbox that fits on the front of the light. This has many advantages. Normally to make a light soft, it is necessary to put a diffusion frame in front of it; then to control the spill, several flags are needed. This means there might be as many

Figure 8.23. An extra-large *space light* (suspended from the same circular truss shown in Figure 8.20) in a lighting rig designed and executed by gaffer Michael Gallart and lighting director Tony Nako. (Photo courtesy of Michael Gallart.)

Figure 8.24. A *China ball* suspended from a C-stand. These are a cheap and extremely lightweight source of softlight and are easily rigged.

Figure 8.25. The *Softsun 100K* by Lightning Strikes, currently the most powerful light available.

as six stands. This becomes a real problem when you need to move the light quickly. A softbox such as a Chimera makes the entire unit fit on one stand. They are often used with a soft *eggcrate* on the front, which helps control the spill. Figures 8.21 and 8.22 show Barger Baglights in use on a commercial with DP Tom Denove. The reason there are so many lights on the shot is that the model is constantly in motion. Every light is on a dimmer, and they were constantly being dimmed up and down for different shots. The Fresnels were controlled by a dimmer board, but the Barger Baglights were controlled by turning switches on and off, which is a real advantage of the Barger. Each bulb inside has its own switch on the back of the unit, making intensity control quick and easy.

COLOR-CORRECT FLUORESCENTS

Color-correct fluorescent tubes have gained enormous popularity in recent years. Pioneered by the Kino Flo company, they are extremely lightweight, compact, and portable sources. Achieving a truly soft light can be difficult and time consuming. Whether it's done by bouncing off a large white surface or by punching big lights through heavy diffusion. Either way takes up a lot of room and calls for a lot of flagging to control it.

Kino Flos had their origin in 1987. While working on the film *Barfly*, DP Robby Mueller was shooting in a cramped interior that didn't leave much room for a conventional bounce or diffusion soft source. His gaffer Frieder Hochheim came up with an answer: they constructed high-frequency fluorescent lights. By using remote ballasts, the fixtures were maneuverable enough to be taped to walls, and mounted behind the bar. Kino Flos were born (Figure 8.27).

Unlike conventional fluorescent ballasts, which can be quite noisy, especially as they age, their ballasts were dead quiet and their light was flicker-free due to the higher than normal frequency. There are now several companies that make these types of lights, including Mole-Richardson. The ballasts are high-frequency, that eliminates the potential problem of flicker which is always present with fluorescent type sources. Second, the bulbs are truly color-correct. Colored bulbs are also available for various effects, as well as for greenscreen, bluescreen or redscreen. Kino makes a variety of extremely large rigs that can either frontlight or backlight an effects screen.

An added bonus of color-correct, high-frequency fluorescents is that they generate considerably less heat than either tungsten or HMI, which is a great advantage in small locations. For example, they are extremely popular in television newsrooms, which often have lights on 24 hours a day.

OTHER TYPES OF UNITS

Besides Fresnels, open face, LED, and fluorescent sources, there are a number of other kinds of lights that are commonly used for film and video lighting.

Softsun

Lightning Strikes makes the *Softsun* series of lights in a variety of sizes from 3.3K to an amazing 100K (Figure 8.25). SoftSuns require no warmup time. They achieve maximum power and proper color temperature the moment they are turned on. SoftSuns are also the only daylight color temperature light source that can be dimmed with minimal shift in color temperature.

Figure 8.26. Balloon lights require minimal rigging. The museum would have not permitted installation of a heavy-duty lighting grid above the Egyptian temple. In this setup, the balloons have black skirts, which contain and control the spill. (Photo courtesy of Sourcemaker.)

Cycs, Strips, Nooks and Broads

When just plain output is needed, broad lights are strictly no-frills, utilitarian lights. They are just a box with a double-ended bulb. As simple as it is, the broad light has an important place in film history. In classical Hollywood hardlighting, the fill near the camera was generally a broad light with a diffuser. The distinctive feature of the broad light is its rectangular beam pattern, which makes blending them on a flat wall or cyc much easier: imagine how difficult if would to be smoothly combine the round, spotty beams of Mighties or Fresnel lights.

The smallest version of the broad is the *nook*, which, as its name implies, is designed for fitting into nooks and crannies. The nook light is a compact, raw-light unit, usually fitted with an FCM or FHM 1000 watt bulb. The nook is just a bulb holder with a reflector. Although barn doors are usually available, nooks aren't generally called on for much subtlety, but they are an efficient and versatile source for box light rigs, large silk overhead lights, and for large arrays to punch through frames.

A number of units are specifically designed for illuminating cycs and large backdrops. For the most part they are open face 1K and 1.5K units in small boxes; these are call cycs, cyc strips, or *Far Cycs* (which create a more even distribution up and down the background).

Chinese Lanterns and Spacelights

Chinese lanterns (*China balls*) are the ordinary paper globe lamps available at houseware stores (Figure 8.24). A socket is suspended inside that holds either a medium-base bulb (household, ECA, ECT, BBA, BCA, etc.) or a 1K or 2K bipost. Just about any rig is possible if the lantern is large enough to keep the paper a safe distance from the hot

Figure 8.27. Color-correct fluorescents by Kino Flo. Their light weight makes rigging them easier and quicker. Notice how the large window at left rear has been *blacked out* with a large *solid* of black duvetyne. A pipe has been rigged to the ceiling to support some of the lights. Note also the *snoot boxes* on the two tungsten *zip lights*. (Photo courtesy of Kino Flo.)

bulb. Control is accomplished by painting the paper or taping gel or diffusion to it. Similar in principle are *spacelights* (Figure 8.23), which are basically big silk bags with 1, 2, 6, or 12 1K *nook lights* inside. For establishing an even overall base level on a set, they can be quite useful. When cabling, you will want to separate them into different circuits to give you some degree of control over the level. China balls are inexpensive and very easy to rig.

Self-Contained Crane Rigs

There are a number of units that consist of several large HMIs rigged on a crane (Figures 8.28 and 8.29). Most also carry their own generator. Musco was the first of these, but now there are several to choose from. These units can provide workable illumination up to a half mile away and are used for moonlight effects and broad illumination of large areas. The main Musco unit comes with its own 1,000 amp generator, which is typical of this type of unit. The 6K heads are individually aimable by a handheld remote control.

Ellipsoidal Reflector Spots

The ellipsoidal reflector spot (ERS) is a theatrical light, but it is used as a small effects light because of its precise beam control by the blades. Called lekos in the theater, on a film set you will frequently hear them referred to as *Source Fours*. (*Source Fours* is manufactured by *Electronic Theater Controls* (*ETC*).)

Because the blades and gobo holder are located at the focal point of the lens, the beam can be focused sharply and patterned gobos can be inserted to give sharply detailed shadow effects. These lights come in a size defined by their beam angle. The longer the focal length, the narrower the beam. They also make a unit that has a zoom. Some ERS spots have a *gobo* slot that will hold a metal disk that will project a pattern. These patterns come in a vast array of designs.

Figure 8.28. (above) A Mini Musco in use at the Universal Studios *backlot*.

Figure 8.29. (right) A self-contained crane rig on Wall Street. (Photo by Michael Gallart.)

Balloon Lights

Balloon lights provide a powerful and flexible new tool for night exteriors (Figures 8.1 and 8.26). They can be either HMI or tungsten sources. They generate a soft, general fill light for large areas. Perhaps their greatest advantage is that they are much easier to hide than a crane or scaffolding. They are also faster to set up and to move. The disadvantage is that they can be very time consuming and expensive to gel. Wind is a factor when flying balloon lights. The smaller the balloon, the lower the acceptable wind speeds. A good reference is to observe flags: if they're flapping straight out, it's too windy. This introduces an element of uncertainty into their use. Larger balloon lights usually come with an operator.

Handheld Units

Portable handheld, battery-operated units are generally called sunguns. There are two basic types: tungsten and HMI. Tungsten sunguns are either 12 volt or 30 volt and powered from battery belts. Some are designed as sunguns, but some are 120 volt lights converted by changing the bulb and power cable. Typically, a tungsten sungun will run for about fifteen minutes. Sunguns with HMI bulbs are daylight balance and more efficient in output than tungsten units.

DAY EXTERIORS

Day exteriors can be approached in three ways: filling with large daylight balance units such as a *Brute Arc* or HMI, bouncing the existing light with reflectors, or covering the scene with a large silk to control the contrast. Sometimes it is some combination of several of these techniques (Figure 8.30.)

Controlling Light with Grip Equipment

Once you have a light working, you have to control it. As soon as you get beyond what can be done with the barn doors, it becomes the province of the grip department. Grip equipment is wide and varied, but in relation to lighting control it falls into three basic categories: reduction, shadow casting, and diffusion.

Reducing the amount of light without altering the quality is done with *nets,* which are frames covered with a netting material; the purpose is the same as a metal scrim on a light: it reduces intensity without changing the color or hard/soft quality of the light. Just as

Figures 8.30. A day exterior with *negative fill* (the black *12x12 solid* that creates a shadow side) and *shiny board* reflectors that are aimed through 4x4 frames with diffusion. The fill is an *8x8 frame* with *Ultrabounce,* a reflective material. This setup reverses the direction of the light source (the sun). The shiny boards are necessary in order to raise the level of the actors so that they are not significantly darker than the background, which would otherwise be seriously overexposed.

with metal scrims, a *single* (color coded green) reduces the light by one-half stop and a *double* (color coded red) reduces the light by a full stop. The same frames used for nets can be covered with white silk-like material that is a medium heavy diffusion. When they are covered with black *duvetyne,* they are *flags* or *cutters*, which can control spill, cast shadows, or block off flares from the lens. The same silk-like material or solid black duvetyne (a fire-resistant cloth) also comes in larger sizes for butterflies and overheads. These come in various sizes, denoted in feet: 4x4, 6x6, 8x8, 12x12, and 20x20. (Figure 8.30).

FOR MORE INFORMATION ON LIGHTING

Lighting is a vast subject; here we have room only to cover the basics. For more on lighting techniques, photometric data, grip equipment and methods, electrical distribution, bulbs, and scene lighting examples, see *Motion Picture and Video Lighting* by the same author, also published by Focal Press.